Development of Novel Electrocatalysts for Direct Alcohol Electrooxidation

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The direct electrooxidation of fuels in a Polymer Electrolyte Fuel Cell (PEMFC) eliminates the need for a reformer system, but the direct electrooxidation of most fuels other than hydrogen are either kinetically limited and/or are not completely oxidized. These limitations reduce the specific power of the cell and can result in undesired electrooxidation byproducts.

In this paper, we will report on a new class of materials to be used in the direct electrooxidation of alcohol fuels. These new materials are nanocrystalline lanthanide-platinum intermetallic compounds. Lanthanide-platinum intermetallic compounds have been known and studied in bulk form, however if they are to be utilized as electrocatalysts in fuel cells, they need to be produced in a finely divided form. Figure 1 is an X-ray diffraction pattern for a sample of $PrPt_2$ prepared in our laboratory. A small impurity of $PrPt_5$ is present, but no observable amount of PrO_x is present.

From a line width analysis of the major reflections in Figure 1 combined with a regression of the lattice parameter, we estimate the specific surface area of the sample to be 15.6 m^2/g. This is a specific surface area amenable to use in a porous fuel cell electrode. The specific surface area was also measured using a 5-point BET isotherm shown in Figure 2. The BET isotherm was used as an independent estimate of the specific surface area which also gave a specific surface area of 15.6 m^2/g.

We will report on the electrocatalytic properties of lanthanide-platinum intermetallic compounds measured using a PEMFC operating on alcohol feed coupled with on-line gas chromatography.

Figures

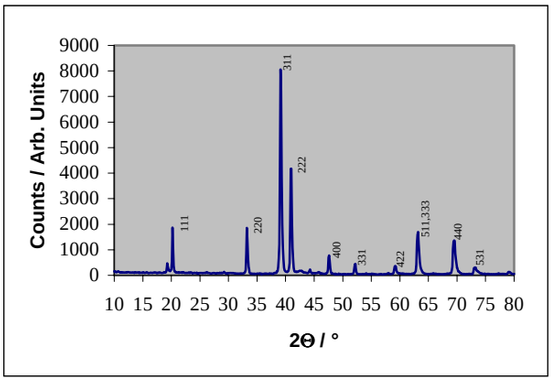

Figure 1 – XRD Pattern for $PrPt_2$ Powder

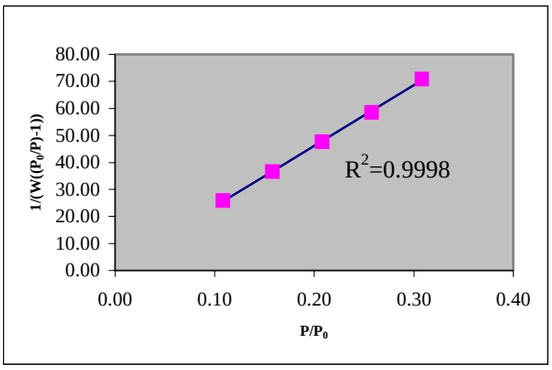

Figure 2 – BET Isotherm of $PrPt_2$ Sample